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ALBERTANS & CLIMATE CHANGE

An Assessment of the Economic Impacts of the Kyoto Protocol

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An Assessment of the Economic Impacts of the Kyoto Protocol

Executive Summary

Alberta is committed to taking effective action on climate change while balancing economic risks and realities for Alberta consumers, business and industry. Alberta has committed to work with other governments in Canada to develop national policies that meet the objectives, principles and outcomes stated by all governments. Alberta is also committed to taking effective action in Alberta, recognizing that these investments will take some time to actually change the trajectory of emissions intensity.

The Kyoto Protocol sets out a specific target, without clearly identifying costs, either economically or in terms of other objectives of Canadian governments. In December 2001, the Alberta Government reviewed current analysis of the costs of implementing the Kyoto Protocol. From that review we learned that there is a wide range of estimated costs of implementing Kyoto. The costs vary because the:

- Size of the challenge is a moving target.
- Competitiveness impacts for Canada with the U.S. opting out of Kyoto are not understood.
- Price range for offsets on international markets will directly affect Canada's costs of compliance.
- There is a need for jurisdictions to commit to a process to jointly determine a national climate change plan with clear rules that will limit costs, liability and competitiveness risks. Clear rules will improve our ability to forecast the costs and predict who will bear them. In particular, it will be important to consider who bears the burden and in what proportion: sectors that compete on international markets; the general public, and governments.
- There is considerable risk to the Alberta and Canadian economies:
  - Risk that current optimistic assumptions will not be fulfilled.
  - Risk that the reduction burden is larger than forecast.
  - Risk that both domestic and international reduction prices will be greater than expected.

THE ANALYSIS UNDERSTATES THE RISKS

On balance, the occasionally optimistic assumptions of the analysis, the failure to deal with the risk of investment flight, the low gap estimate and the risks of distorting trade and investment relations with the U.S., lead to the conclusion that there is high upside risk. This is also related to the lack of any clear policies to limit costs and manage risks.

- Risk that policy uncertainty and poor policy choices would impose costs that lead to investment flight.

We determined that there are a number of steps that should be taken to improve confidence in understanding the risks to the Canadian economy:

- Further analysis needs to be based on very specific policy options.
- We need informed consultation with stakeholders and the public.
- We need federal and provincial agreement on specific policies to reduce uncertainty, set the framework and manage the outstanding risks associated with the Kyoto Protocol.

Alberta review of range of Kyoto impacts

In December 2001, Alberta reviewed our current understanding of the costs of implementing Kyoto. The review was largely based on taking a critical look at the national analysis conducted under the National Climate Change Process by the Analysis and Modeling Group. This was complemented by some microanalysis of key Alberta sectors.

Based on the range of results and the uncertainty captured both in the national analysis and identified during the Alberta review, the results were put into a "range" and risk management context.

Because of the need to forecast multiple variables, it is clear that there are no definitive single conclusions that can be drawn from the analysis. Costs must be understood in terms of the range of risks. Policy clarity will help narrow risks by improving our ability to predict costs and economic impacts. However, in addition to policy clarity Canada's policy approach must be deliberately designed to improve our ability to manage the risks.

Wishing for optimistic outcomes won't make them come true

Single point forecasts ignore the real range of uncertainties and risks. Only by being explicit about risks and uncertainties can we identify, consult and agree on the policies needed to minimize costs and manage risks.

Size of the challenge is a moving target

The first uncertainty is the size of the reduction challenge posed by the Kyoto Protocol. National analysis was based on a precise forecast of emissions growth – the Business as Usual (BAU) case. Our experience in forecasting that challenge has not been good: since it was first forecast as a 160 megatonne (MT) challenge in 1997, it has been revised upward every two years by about 40 megatonnes, to 240 megatonnes as of January 2002. These increases in projected emissions have been necessary because we have consistently underestimated the economic growth that Canada, and Alberta in particular, has been experiencing.

Even these biannual updates may be understating the size of the challenge since they do not reflect all the emissions growth expected in Alberta resulting from planned private sector oil sands development. There are likely several other sectors across the country with expected expansions that have been understated in the analysis. If we have underestimated in one important sector, it is very likely that we have done so in others. Alberta's review suggested that the forecast underlying the national phase one analysis was some 40-80 MT too low. In addition to the problem assumptions made about oil sands development and economic growth, the national analysis assumes a significant shift from coal to natural gas in Alberta's electricity sector. More recently, an additional 2,300 megawatts of coal-fired electricity generation has been proposed to come on-line over the next five to six years. This would mean an increase in emissions from coal-fired power generation rather than a reduction.

The size and cost of the gap or challenge forecasted by the national economic analysis are also underestimated because they assume that a number of actions that will reduce emissions will be made and be effective.

A MOVING TARGET

Canada's Kyoto Gap, the difference between projected emissions and a target rate of six per cent below 1990 emission levels, has been growing.

- *The gap is itself uncertain, a prediction depending on economic activity and policy. These will only be known after the fact.*

Estimates of the gap have been growing:

- *1997: about 160 MT gap estimated*
- *1999: about 200 MT gap estimated*
- *2001/2: about 240 MT gap estimated*
- *2003, 2005, 2007, 2009, 2011 – will the gap continue to grow by 40MT every two years?*

The gap is increasing in part because of other priorities such as jobs, economic regional development, developing secure energy resources for Canadian and U.S. markets.

Forecasted "Business As Usual" scenarios assume reductions

The Business As Usual (BAU) emission rates forecasted in the national analysis assume the implementation of some domestic reduction actions, and therefore underestimate the size and cost of the reduction challenge facing Canada. In effect, the BAU forecast is a "reduction scenario".

The BAU forecast attempts to capture current policy and incorporates a pattern of on-going energy efficiency improvements across the economy. There is some "continuous improvement" built into the base case. This makes it difficult to determine which reductions are related to new programs, and which related to continuous improvement.

The Business As Usual case should be the case without new climate change measures. In other words, new programs must be understood as addressing the gap, and with program costs included in the "costs of Kyoto".

Competitiveness impacts for Canada of U.S. opting out of Kyoto not understood

The first phase of the national analysis was conducted prior to the withdrawal of the U.S. from the Kyoto Protocol. Since the United States is Canada's major market, as well as our major competitor, the implications for the competitiveness of Canada's goods on U.S. and world markets have not yet been studied.

It is very likely that if Canadian goods include an embodied carbon charge and the goods that they compete with do not, the Canadian goods will be put at a disadvantage. The magnitude of that disadvantage would depend on the amount of embodied energy/carbon in a product and the market price of carbon emissions.

If faced with these costs, in order to maintain their international competitiveness, some industries, like car manufacturers, petrochemical companies and oil refineries might choose to invest outside Canada.

The non-involvement of the U.S. in the Kyoto Protocol will also have a number of other implications for modeling:

- The U.S. will not experience any Kyoto-induced economic slowdown so Canada might benefit from on-going demand (which helps overcome its own slowdown).
- The U.S. will not officially participate in international emissions trading, which may reduce prevailing international reduction prices.

Price range for offsets will directly affect Canada's costs of compliance

The cost to Canada of meeting a Kyoto target will be decided by a combination of the costs of domestic reductions and the cost of purchasing international offsets. Where the costs of domestic reductions exceed the cost of international offsets, Canada can keep the costs of Kyoto compliance down by buying those international offsets until it reaches its Kyoto quota. Any policies that limit the access, or predetermine a balance between the use of domestic reductions versus international offsets, would increase the cost of Canada complying.

There is a great deal of uncertainty about international prices so this is a key risk that requires management. Expectations of low prices are based on non-participation of the U.S., an assumption that contradicts the basic logic of Kyoto. Moreover it assumes an abundance of Russian "hot air" without any Russian attempt to exercise market power. Finally, some observers believe that without the U.S., Canada will be the largest international credit purchaser thus influencing and exposed to international prices. Since this is an uncontrollable factor, it requires a risk management policy.

RISK OF DE-LINKING NORTH AMERICAN MARKETS

The risk of creating different rules and different costs for competitors in the broad North American market creates a real risk of decreased competitiveness, loss of investment and loss of trade. Canada would be the only partner in NAFTA that is subject to an emissions target under the Kyoto Protocol. A continental energy policy could also be jeopardized by Canada's commitment to a Kyoto target.

The path forward for economic analysis:

In order to proceed to an informed decision, there is additional information and analysis required:

- Need to narrow analytic range by grounding analysis in specific policy options.
- Need to test analysis with involved stakeholders and general public through informed consultations.
- Uncertainty kills – need to ensure there is federal-provincial agreement that addresses specific policies to remove uncertainty and manage risk prior to ratification decision.
- Policy approaches need considerable flexibility because there is too much uncertainty for rigid approaches:
  - This means need to involve consumers
  - Need for trading system
  - Need to include all sinks and sources
- Policy approaches must include investment for future economic reductions such as technology, and in behavioral change, such as conservation.
- There is a need to identify the policy approaches which lead to the desired outcomes: enhanced competitiveness; no unfair burdens; efficiency and effectiveness (in achieving reductions).
- Limiting liability seems essential to maintaining growth in key sectors, especially energy.
- Approaches need to be coordinated with the U.S., or there is a risk of disrupting trade and investment flows.

Improving understanding of risks to the economy

The first phase of national analysis was conducted prior to the withdrawal of the U.S. from the Kyoto Protocol. Using several scenarios, models, and sensitivities, it identified a range of outcomes.

The Alberta review captured the range – focusing on the runs that bore the closest resemblance to current expectations, and embodied the most "behavioral" rather than "theoretical" model assumptions. The Kyoto Loose scenarios based on the behavioral Canadian Integrated Modeling System (CIMS) model reflects an open, relatively low-priced international reductions market with U.S. doing 75 per cent of its actions abroad.

Critical review of the analysis identified a number of factors that would broaden the range of results – factors that lead to both lower and higher cost forecasts.

Again, the most critical factors seem to be the size of the reductions gap and the risks of investment flight – especially in light of the withdrawal of the U.S., Canada's largest trading and investment partner.

It should also be noted that these models describe the eventual outcome or economic equilibrium. None of the models attempt to capture possible economic "churning" as the economy attempts to adapt to new constraints. Moreover, the modeling runs assume incremental new capital is attracted to make emissions reduction investments. This is an assumption that is difficult to reconcile with reality – capital constraints and a competitive international market for investment capital.

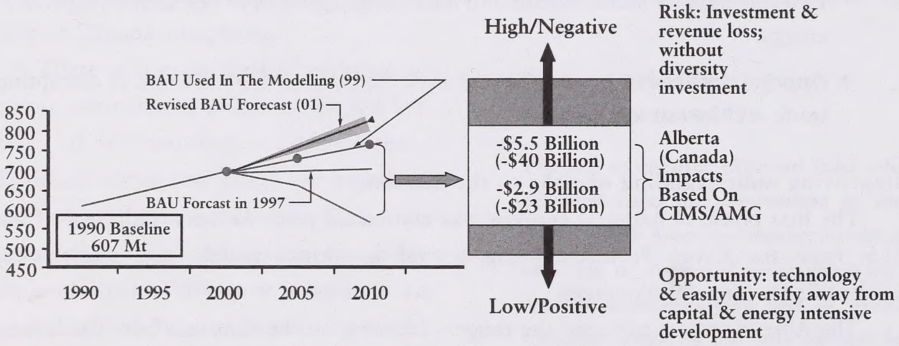
It is also clear that the models understate the long-term (i.e., post Kyoto commitment period) potential of technological breakthroughs to reduce emissions.

Much has been made of the increase in sinks allowable under the Kyoto Protocol. While this revision of the Kyoto rules has the potential to reduce the cost of Canada's meeting the Kyoto target, it is uncertain how that sink potential can be met by the Kyoto commitment period.

The national analysis tried to take into account other environmental and health benefits. These were factored into the choice of measures proposed by the original issue tables. However, these benefits were presented separately to ministers so they could compare the "economic assessment" and the more qualitative "other benefits" assessment. It is unlikely that any of these health benefits would be evident by the commitment period.

Our review indicates a broader range of economic risks to Alberta

Range of National and Alberta Impacts



Based on the forecast gap in 2000, the models that try to predict behavior in the economy show a reduction in expected Alberta economic activity of between $2.9-$5.5 billion (by 2010 in current dollars). The overall impact for the country is estimated to be $23-$40 billion dollars.

Sustained negative impact on Alberta

Alberta is at risk of facing a large and sustained negative economic impact if Canada were to ratify the Kyoto Protocol.

Great uncertainty remains with respect to the potential range and magnitude of impacts. The magnitude of impact will be depend on the specific policies adopted under the national strategy – which we can determine – and international factors which are beyond our control – and thus require active risk management policies. Clearly there are model runs and assumptions that deliver lower estimates of costs. Some even deliver positive results. However, such models assume:

- Complete recycling of investment in Canada – no investment flight.
- Ability of new sectors to attract capital not taken up by the sectors that are our current "engines of growth".

The risk to Canada

Alberta briefly reviewed Canada in comparison with other countries. Most international comparisons show Canada as the most challenged among countries currently contemplating greenhouse gas emission caps.

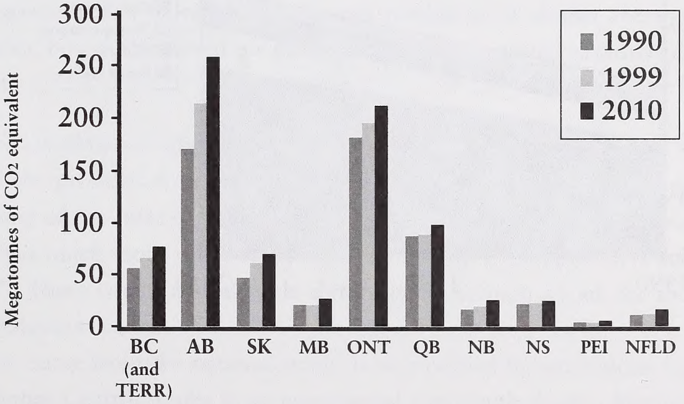
The Australian modeler, ABARE, for example, indicates that Canada's potential impact could be more than double that of Australia, more than four times that of the European Union, and almost 10 times that of Japan.

The uncertainty of the macro-economic analysis and its interpretation suggested a need to focus on more specific analysis – where are the emissions, what are the estimated cost of reductions, what would such costs means for consumers and key Alberta sectors?

Where are the emissions?

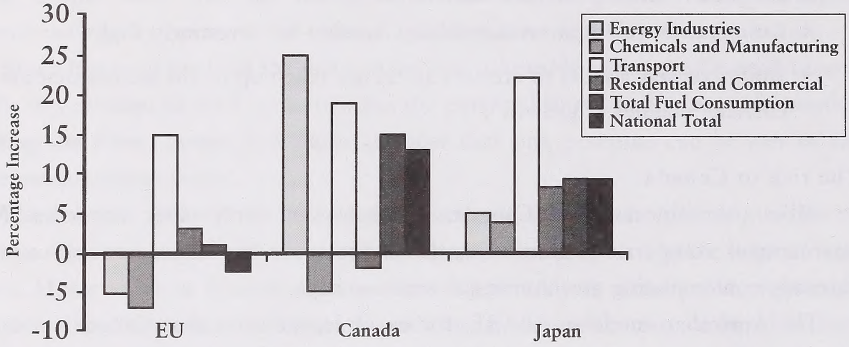
Emissions are forecast to grow in all jurisdictions. However, growth is strongest in jurisdictions actively developing their resources.

Emissions by Province



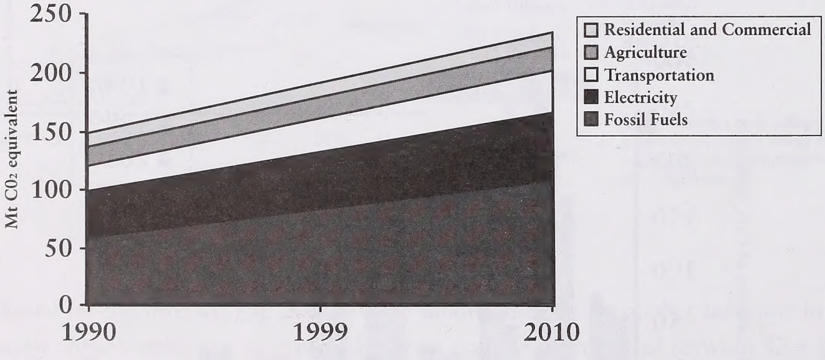
International comparisons show how unique Canada is – its emission growth is largely associated with energy development, especially export-oriented development to meet North America's growing need for secure energy.

National Emissions - 1990 versus 1998



Alberta's forecast emissions growth is fuelled by energy development. Because of the anticipated increase in oil sands and other energy development, Alberta is growing as a percentage of Canadian emissions.

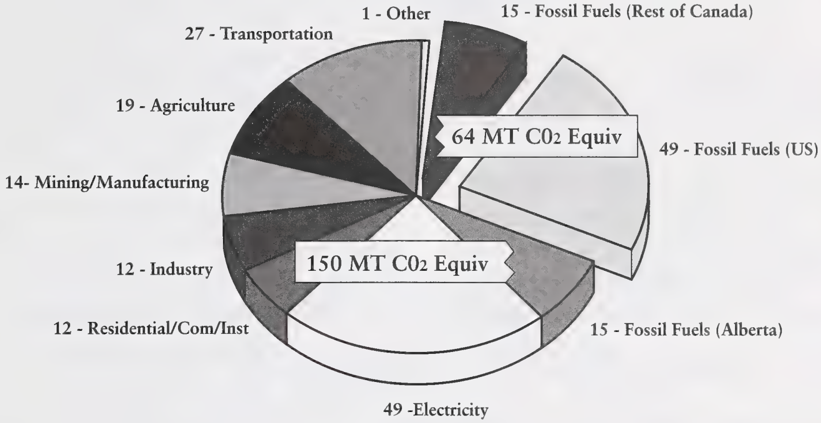
Alberta Emissions Growth: Key Sectors



Of course, a substantial portion of current Alberta emissions and Alberta's emissions growth are associated with production of energy for the U.S. and the rest of Canada.

Alberta Emissions - 1999

Upstream Ex-AB and Export O&G Attributed
(In Megatonnes)



Cleaner energy exports

The federal government has started international discussions focused on cleaner energy exports – reflecting that energy is internationally competitive, contributing to international environmental objectives, as well as continental security concerns. Having just begun, the result of these discussions is unclear.

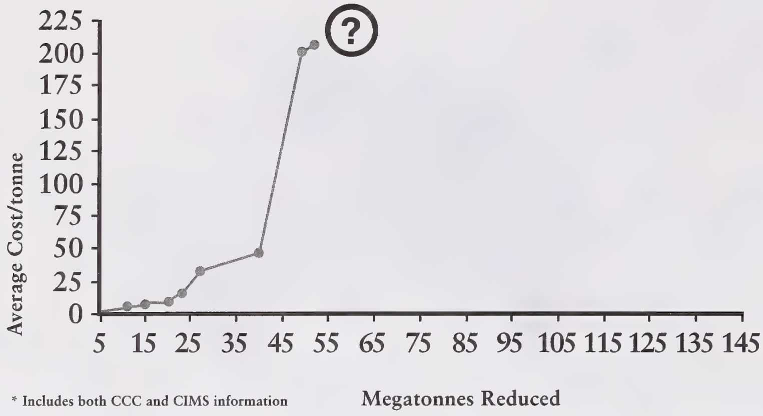
This is an important issue, because much of Canada's emissions growth is associated with energy development – consistent with federal and provincial policy objectives. This issue needs to be resolved in order to meet the objectives of maintaining competitiveness and avoiding undue burden – objectives or principles shared by all Canadian governments. However, satisfactory resolution of cleaner energy exports is not a panacea, but an element of the package of policies required to clearly define costs and burdens.

What do the models say about emission reductions?

One of the products from the national climate change process was a preliminary understanding of the costs of reducing emissions. In reviewing the phase one analysis, it is clear that much more needs to be done to develop a "supply curve for emission reductions". There is still considerable difference of opinion about the shape of the emissions reduction curve.

The cost curve from the national analysis as modified by work done by Alberta's Climate Change Central results in an exponential curve with sharp inflection points at $10 and $40 per tonne. The curve suggests approximately 25 megatonnes of reduction could be achieved for $25/tonne.

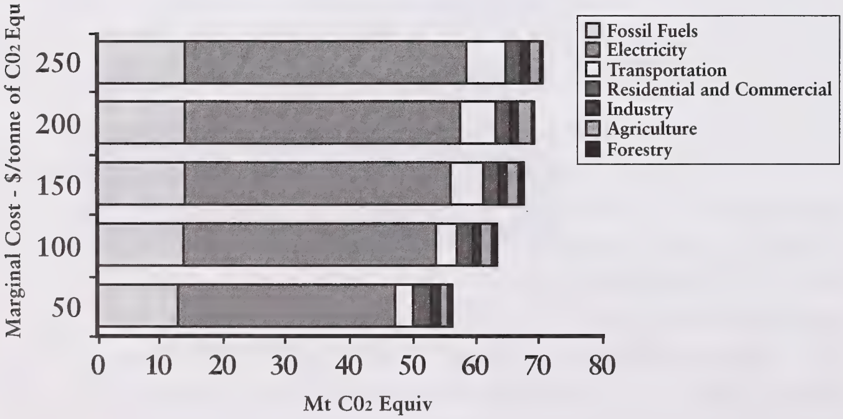
Alberta Cost Curve - Adjusted*



* Includes both CCC and CIMS information

The CIMS cost curve provides some indication where reductions occur, at approximately what prices.

Cost Curves - Sectoral Reduction Contribution



The largest portion of the emission reductions, at all levels, comes from the electricity sector – specifically from the thermal generation sector.

These reductions are expected to come from choice of natural gas over coal for thermal generation, and from some efficiency gains, but primarily from capture and storage of carbon dioxide in geological reservoirs.

Since the first phase analysis, North America experienced volatile natural gas and electricity prices, which have reawakened interest in diversifying thermal electric fuels, to reduce electricity price volatility. Two new thermal plants are in the approval process, a third is under discussion.

While Alberta is actively pursuing carbon capture and storage, it seems clear that the estimates in the cost curve are ambitious in terms of the timing, quantity and cost of that activity.

COSTS AND RISKS OF REDUCTIONS

The estimated cost curves for emission reductions seem uncertain. Some observers see them as flat – with large reductions available at relatively low prices.

From our review, it appears that cost rises quite steeply. Moreover, the cost curves assume fairly large reductions from electricity and carbon capture and storage that are uncertain in time, quantity and cost. This additional uncertainty is part of the "risk" that needs to be managed in responding to climate change.

Domestic vs. international reductions

The analysis seems to suggest a relatively limited capacity to reduce emissions at low costs, compared with the growing "Kyoto Gap." This suggests a need to rely on international reduction credits.

Indeed, ABARE suggests Canada would become the largest international credit purchaser in the absence of the U.S..

This raises a number of questions:

- Who will purchase the credits?
- What is the size of the capital outflow?
- Will Canadian emissions reduction efforts be capped at the international emission price?
- Is there a safety valve if international prices exceed expectations?

Cost implications for energy producers and consumers

The cost curves suggest the cost of action could well be in the $10 to $25/tonne range or higher if there are policy restrictions on the ability to access the international emissions market. This level of costs will affect both consumers and producers.

The Alberta analytic review compared the implicit value of carbon in the reduction curves with potential impact on energy commodity prices.

Risk: Increased Cost of Energy Production Only Half the Story

$/tonne C02e	Electricity $/KWh	Conventional Oil/bbl	Heavy Oil/bbl	Synthetic/bbl	Natural Gas/Gj
$10	$0.01	$0.30	$0.58	$0.90	$0.05
$24	$0.02	$0.71	$1.40	$2.16	$0.13
$45	$0.04	$1.33	$2.62	$4.05	$0.24
$58	$0.06	$1.71	$3.38	$5.21	$0.30
$250	$0.25	$7.38	$14.55	$22.48	$1.30

For example, a reduction burden of $10/tonne CO_2e (CO_2 equivalent) is equivalent to about a dollar in costs on synthetic crude oil.

In a world where oil sands investment is “marginal” – based on comparing an average price of $18-$20 U.S. against a “supply cost” of essentially the same range – additional costs will frustrate investment, in favor of non-Annex One countries with no Kyoto costs.

If the costs are visited on the oil supply sector, the result will be both investment flight and loss of government revenues.

Alberta’s analysis shows a potential impact on provincial government revenues of $225 million per $10/tonne CO_2e costs from existing oil and gas operations. This understates the revenue impact, because it does not take into account foregone revenue from lost investment, or associated income and other tax revenues.

Alberta’s oil sands are abundant and accessible sources of crude oil. With the continuing decline of conventional North American crude oil reserves, the focus is turning towards oil sands development and production. Oil sands production for 2000 averaged 605 thousand barrels a day, representing 30 per cent of Canada’s crude output. By 2005, oil sands production is expected to account for 50 per cent of total Canadian crude oil output and 10 per cent of North America’s output. Based on existing and announced investment of over CDN$55 billion, it is expected that oil sands production will almost triple by 2010.

In associated work, the Canadian Association of Petroleum Producers (CAPP) has summarized the currently planned investment, the investment at risk, and the associated employment and production.

Industry Says Impacts Could Be Higher

	Jan. 2001	Jan. 2002
Projects Announced	$51 billion	$86 billion
• Completed since 1996	$11 billion	$17 billion
• Under Construction	$10 billion	$7 billion
• At Risk/Under Evaluation	$30 billion	$62 billion
• Forecast (Business Risk)	$17 billion	$25 billion
Government Revenue (30 yrs)	$250 billion	$325 billion
Jobs	70,000/yr	90,000/yr
Production	2 million	2.6 million

Alberta's oil and natural gas exports go almost exclusively to the United States. From the U.S. perspective, Alberta's market share in the U.S. is as follows: 11 per cent of the natural gas market as compared to one per cent for the non-Annex B countries, five per cent of the crude oil market as compared to 36 per cent for the non-Annex B countries.

Costs of GHG reductions

Testing GHG reduction costs against the economics of specific sectors shows the vulnerability of investment, jobs and revenues to policy choices. Unless policies are specific, the impacts can be dramatic.

Alberta production is a price taker in the U.S. market. This means that any costs for greenhouse gas emission (GHG) reduction increases the costs of operation. What this means is reduced activity, reduced investment and reduced revenues.

It is estimated that at present the average operating cost per barrel of oil is $5.40 in Alberta. If industry was confronted with $10/tonne reduction costs, this could be equivalent of a five per cent (light and medium) to 10 per cent (heavy oil) increase in operating costs. Alberta's analysis indicated a cumulative three per cent annual reduction in light and medium conventional oil production from new wells resulting in a 34 per cent drop in production after 10 years. Similar impacts would be seen for heavy oil.

The national analysis assumed that Canadian natural gas exports would increase to compensate for lower development and returns in other commodities. However, high levels of a natural gas exploration and development have been required simply to maintain production. Despite higher than forecast prices, the Alberta Energy and Utilities Board is forecasting a decline in natural gas production post 2003. This suggests that some of the offsetting GDP growth in the national analysis may not occur.

Other tests of pricing levels

Comparing reduction costs with forecast emission reductions, suggests costs that would create real difficulty if, for example, the energy sector faced those costs. The costs also seem dramatic when traced through to consumers. The analysis forecasts a higher cost. There is risk of much higher consumer energy prices in the short term.

Emerging opportunities

The Alberta review considered the technology opportunities for advancing Alberta's energy economy. These included: carbon dioxide capture and storage, broad energy sector technology development, increased natural gas development, especially coal bed methane, increased energy efficiency, biological sequestration, trading and adaptation.

The review concluded that while the opportunities required further evaluation and investment, substantive results would not be felt in the 2010 timeframe, they would be seen a decade later.

Conclusions

There is a broad range of analytic results:

- It is important to understand it as a legitimate range, and to take deliberate action to drive costs to the low end of the range, and to put in place policies to manage risks outside our control.
- What we are dealing with is inherently uncertain – deriving false comfort from optimistic conclusions will leave us unprepared, and increase uncertainty and skepticism.
- The national analysis broadly understates the risk range, and there is greater upside risk.
- Policy certainty is required in order to narrow the cost range.
- Macro-economic outcomes are difficult to interpret. Numbers that seem small are large compared with other countries.
- Emission projections may be optimistic in price and quantity, and also in time. In several areas, immediate action is required, but the investments will only achieve reductions in the future.
- Despite optimistic assumptions, reduction costs quickly mount above expected international prices:
    - Policy constraints, which limit access to international markets or require specific proportions of domestic reductions risk incurring higher than international costs.
    - International prices may prove volatile; they are unreliable safety valves.
- When tested against key sectors, such as oil and gas, the projected costs of greenhouse gas (GHG) reductions will discourage new investment and erode current operations:
    - Simply levying costs on all sectors will prove costly and counterproductive.
- Growth in the oil sands, strategic to Canada's North American secure energy supply role, is endangered by perceived exposure to GHG costs.

Despite the best mitigation efforts and successes of world governments to reduce greenhouse gas emissions, there will likely be long-term impacts on future generations. We need to start now in order to make a difference.

We will also need to plan and adapt to the impacts of climate change.

Alberta recognizes and strongly agrees that climate change is a growing concern to all Canadians, and there is no question that some action must be taken to address the issue.

However, as a province we are just as concerned about our nation's competitiveness and economic well being. Specifically, our concern stems from the fact that much of the work and analysis of the National Climate Change Process, established in 1997, was undertaken before the decision by the U.S. to withdraw from the Kyoto Protocol.

With the importance of trade and investment between Canada, the U.S., and Mexico, actions or programs undertaken by Canada to address climate change must be developed in a North America context. Discussions on climate change between Canada, the U.S. and Mexico are vital to ensuring Canadian business and industry is on a level competitive playing field with economies that are so closely linked to our own.

Alberta has identified a considerable range of risks, which must be explicitly addressed through specific analysis, informed consultation with stakeholders and our publics, and through agreed-upon policies to limit costs and manage risks.

We cannot overstress the importance of making a fully informed decision.

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